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BY

D. W. PRENTISS, M.D.,

OF WASHINGTON, D.C.

NOTE ON THE ACTION OF DIGESTIVE FLUIDS ON OIL.

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H. W. WILEY, M. D,

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FROM

THE MEDICAL NEWS,

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OLIVE OR COTTON-SEED OIL IN THE TREATMENT OF GALL-STONES.

BY D. W. PRENTISS, M.D.,
OF WASHINGTON, D. C.

QUITE a number of reports of cases have recently appeared in the medical journals, of the treatment of biliary colic by the use of large doses of olive oil, in which relief has been obtained, and in which are mentioned the appearance in the stools of numerous semi-solid, rounded masses of varying size. Some of the reporters have characterized these masses as gall-stones, while others, criticising this diagnosis, say they are concretions from the excess of oil taken, which latter is the correct position. The latest case is reported in the *Medical Record* of April 14, 1888, in which Dr. Thomas W. Street, U. S. N., says they are really gall-stones, for "when dried they exhibit facets."

All the cases heretofore reported have been in reference to the use of olive oil. Considering the fact that cotton-seed oil is so nearly identical in all its properties, I ordered it instead of olive oil in the case here reported; its effects also seemed to be identical.

I first made use of olive oil, eight or ten years ago, in the case of a man who had had repeated attacks of biliary colic, and had previously taken various remedies without relief. After taking twelve ounces of olive oil, he passed, as he thought, a large number of gall-stones, and his health immediately improved. He had no return of the attacks of colic as long as he continued under my observation, which was about two years.

In December, 1886, a case came under my care, of repeated attacks of violent pain in the region of the liver, followed by jaundice.

Mr. R., about forty years of age, Government clerk, with correct habits, an active, hard worker when well, but of spare habit. He became very much emaciated under these attacks, which recurred so frequently that he was continually jaundiced. I could discover no organic disease of the liver. He was under treatment from December, 1886, to June, 1887, by various remedies, among which were quinine, mercurials, terebinthinated ether, muriate of ammonium, and cod-liver oil. But he did not improve, and early in June he consented to take a pint of *cotton-seed* oil, and being a man of resolution, he drank the whole pint, keeping it down with difficulty.

I instructed him to look out for gall-stones, and the next morning his wife brought me triumphantly a number of semi-solid, greasy looking balls of varying sizes, from a pea to a hickory-nut. Mr. R. was greatly relieved, the jaundice shortly disappeared, and he continued well until December, 1887, when the attacks of colic and jaundice recurred. A pint of

cotton-seed oil was again prescribed for him, and taken as before—this time, however, with more difficulty in swallowing and retaining it than the first time. The following morning he brought me a dozen or more of these greasy looking, semi-solid balls, taking great comfort in believing them to be gall-stones, and said he had passed a "pint of them." He was relieved, and, up to this date (April, 1888), has had no return of the disease.

I did not undeceive him as to the nature of the concretions, thinking his state of mental satisfaction over this extraordinary discharge of gall-stones could do no harm. Besides, I was not quite sure myself what they were, though believing them to be concretions of the oil taken. I placed them in a wide-mouthed bottle for further examination, and found, after a few days, that they had liquefied.

In talking over the subject with Prof. H. W. Wiley, Chemist of the Agricultural Department, he expressed doubt if the oil could be saponified in the intestines to the extent which the case seemed to indicate, and kindly offered to analyze the specimen. The specimen was sent to him, and I append his report as it was made to the Chemical Society of the District of Columbia. This analysis is of special interest, as it is, I believe, the only analysis of these concretions upon record.

Dr. Robert T. Edes, in his new text-book on *Materia Medica and Therapeutics*, 1887, p. 287, has the following expression: "Large doses (of olive oil), a pint per diem, have been prescribed for gall-stones, with the result of producing discharges of

small, semi-solid masses resembling and sometimes mistaken for gall-stones. They are, however, really lumps of soap, formed by the oil with the alkalies of the intestinal secretions." The analysis of Prof. Wiley confirms the statement of Dr. Edes that these masses are true soap.

Prof. Wiley's "Note" is as follows: "The action of the gastric juice on fat seems to be confined to separating therefrom all connective and enclosing tissue, and thus setting the fat free. It is found in the stomach in large globules, and passes the pylorus unchanged. The pure intestinal juice seems to exert no action whatever on fats, and these substances are said by Busch to appear in the feces unchanged, when subjected to the action of the intestinal excretions alone.

"Flint says, that while the action of the pancreatic juice in emulsifying fat is undisputed, there is no evidence that in normal digestion there is ever any saponification. The fats found in the thoracic duct are always neutral, and do not contain any free fatty acid. On the other hand, Bernard has shown that the pancreatic juice outside of the body has a distinct power of saponifying fats. Landois and Sterling, however, recognize the saponifying power of the pancreatic juice in normal digestion, but attribute the result to a fat-splitting ferment called steapsin. The process of emulsification is said to go on with much greater rapidity when the fat in question contains a trace of free acid. The surface of each fat globule becomes coated with a thin film of soap, which is soon detached, carrying with it minute

particles of fats. The repetition of this process secures finally a complete emulsification. Both the soap and emulsion are absorbed. The authors state further that soluble fat soaps represent only a fraction of the fats which are absorbed, the greater part of the neutral fats being absorbed in the form of an emulsion. Absorbed soaps, however, have been found in the chyle.

"Dr. Prentiss, of this city, administered to a patient a large dose (a pint) of cotton-seed oil. In the dejecta were found large numbers of moderately hard, ovoid bodies which the patient thought were gall-stones. They were brought to Dr. Prentiss, who preserved them in a stoppered bottle, and sent them to me for examination.

"On reaching me the whole had melted to a viscous mass resembling soft soap. On examination, it proved to be a true soap, easily soluble in alcohol, yielding fatty acids, insoluble in water on treatment with an acid. After saturation with hydrochloric acid, the chlorides of the alkalies were separated from the fatty acids by filtration, evaporated to dryness, ignited to low redness to drive off any ammonia and to destroy organic matter; the residual chlorides dissolved in water, filtered through a small filter, evaporated nearly to dryness, dissolved in alcohol, and treated with platinic chloride: a distinct precipitate of potassio-platinic chloride was formed. The chief part of the alkali, however, was soda. This is an interesting case, showing the complete saponification of a large quantity of oil by the pancreatic juice and bile, and the passage of the greater

quantity of soap thereby formed, unabsorbed, through the alimentary canal.

"Since the favorable effect of alcohol in promoting saponification is so well established, the deportment of the patient in question in respect of the ethics of temperance would be a matter of interest."

[Reprinted from THE MEDICAL NEWS, July 28, 1888.

NOTE ON THE ACTION OF DIGESTIVE FLUIDS ON OIL.

BY H. W. WILEY, M.D.,
OF WASHINGTON, D. C.

IN a paper by Dr. D. W. Prentiss (THE MEDICAL NEWS of May 12, 1888, p. 518), attention was called to the occurrence of so-called gall-stones in the dejecta after the exhibition of olive or cotton-seed oil, and the substance of a preliminary study which I had made of the compositions of these bodies was given. At Dr. Prentiss's request I have since collected additional data referring to this matter.

The action of the gastric juice on fat seems to be confined to separating therefrom all connective and enclosing tissue and thus setting the fat free. It is found in the stomach in large globules and passes the pylorus unchanged.

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evidence that in normal digestion there is ever any saponification. The fats found in the thoracic duct are always neutral, and do not contain any free fatty acid. On the other hand, Bernard has shown that the pancreatic juice outside of the body has a distinct power of saponifying fats. Landois and Stirling, however, recognize the saponifying power of the pancreatic juice in normal digestion, but attribute the result to a fat-splitting ferment called *steapsin.*

The process of emulsification is said to go on with much greater rapidity when the fat in question contains a trace of free acid. The surface of each fat globule becomes coated with a thin film of soap, which is soon detached, carrying with it minute particles of fat. The repetition of this process secures finally a complete emulsification. Both the soap and emulsion are absorbed. The authors state further that soluble fat soaps represent only a fraction of the fats which are absorbed, the greater part of the neutral fats being absorbed in the form of an emulsion. Absorbed soaps, however, have been found in the chyle.

Buchheim, in his *Lehrbuch der Arzneimittellehre,* third edition, p. 370, says: "The pancreatic juice also possesses the property of dividing fats into fine particles, at the same time that it effects, by reason of a ferment contained therein, a partial saponification of them."

Edes (*Therapeutics and Materia Medica,* p. 287) refers to the saponification of olive oil when administered in large doses, and the excretion of semi-solid masses of soap.

What relation the saponification of fat in the intestinal canal may have to its food value I cannot say. Recent experiments of Kellner (*Zeitschrift für Physiologische Chemie*, vol. xii. p. 113) show that as a food for a draught horse one part of fat is equivalent to 2.6 parts of starch. Six and a half ounces of linseed oil enabled a horse to perform 464,000 pounds more work in a day than without this food. Hoppe-Seyler (*Physiologische Chemie*, Part IV. p. 949) ascribes the power of fat food to increase the amount of work performed to its influence in diminishing the consumption of the nitrogenous tissues. Whatever the true view may be, it seems certain that we have not yet quite understood the exact processes of fat-digestion and assimilation.

Dastre, in a recent study of the action of the bile in fat digestion (*Comptes Rendus*, tome 106, p. 217), has shown that the pancreatic juice alone is not capable of digesting fats. These conclusions of Dastre have just been confirmed by the experiments of Prevost and Binet (*Comptes Rendus* of June 11, 1888, p. 1690). These investigators find that in dogs, when the bile is prevented from taking part in digestion, fat foods are voided unchanged.

By an artificial cholecysto-intestinal fistula in dogs, they caused the bile to be emptied into the intestinal canal at a point twenty-five to forty inches from the duodenum. Through all this distance the fatty matters passed, subject to the action of the pancreatic secretion alone. The dogs being killed during the progress of digestion, the chylefers were examined. There was no trace of any absorption

of the fat until after the mingling of the bile with the contents of the canal. Whence Dastre concludes that the presence of both bile and pancreatic fluid is necessary to the digestion of fats.

Dr. Prentiss, of this city, administered to a patient a large dose (a pint) of cotton-seed oil. In the dejecta were found large numbers of moderately hard ovoid bodies, which the patient thought were gall-stones. They were brought to Dr. Prentiss, who preserved them in a stoppered bottle and sent them to me for examination. On reaching me the whole had melted to a viscous mass resembling soft soap. On examination it proved to be a true soap, a mixture of soap and free fatty acids, easily soluble in alcohol, yielding fatty acids insoluble in water on treatment with an acid. After saturation with hydrochloric acid the chlorides of the alkalies were separated from the fatty acids by filtration, evaporated to dryness, ignited to low redness to drive off any ammonia and to destroy organic matter; the residual chlorides were dissolved in water, filtered through a small filter, evaporated nearly to dryness, dissolved in alcohol and treated with platinic chloride. A distinct precipitate of potassio-platinic chloride was formed, showing a trace of potassium. The chief part of the alkali, however, was soda, with, possibly, some calcium. This is an interesting case, showing the complete saponification or decomposition of a large quantity of oil by the pancreatic juice and bile, perhaps with the aid of a fat-splitting ferment, and the passage of the greater

quantity of soap and acids thereby formed unabsorbed through the alimentary canal.

Since the complete saponification of such an amount of oil would require more alkali than is normally found in the intestinal canal, it seems probable that the oil may be split up in the canal without complete saponification. I have, unfortunately, taken all the sample sent me for the first examination and therefore will not be able to decide this point until opportunity for another analysis is presented.

The occurrence of semi-solid masses in the feces has been noted by many writers, but they have usually been called gall-stones. The *Therapeutic Gazette* for May, 1888, reports a case of this kind, but evidently without believing it true. As has already been noted, Dr. Edes has properly named these excretions, but informs me that he does not know of any analysis of them having been made.

Mojon (*Revue Médicale*, 1844, quoted in Thudichum's *Treatise on Gall-stones*, p. 199) says, "concretions of solid fat occur in the feces after the use of sweet oil;" but in this he is evidently mistaken. Sweet oil could not produce a concretion of solid fat without undergoing a more profound change than saponification. These concretions were, doubtless, masses of soap, such as I have described above. Thudichum (*Treatise on Gall-stones*, p. 135) describes certain biliary calculi which were composed largely of calcium soaps. The hardness and crystalline structure of these stones, however, would prevent them from being confounded with the

masses of soap and acids forming the subject of this study. In the feces of dogs, Hoppe-Seyler (*Physiologische Chemie*, p. 337) has found calcium soaps of stearin, palmitin and olein. The feces are exhausted with alcohol and ether, and the residue treated with hydrochloric acid and a mixture of alcohol and ether. Wegscheider (*op. cit.*) has found these calcium soaps, also, in the feces of healthy children who were nourished exclusively by mother's milk.

I desire to thank Drs. Prentiss, Edes and Lee for favors extended in the preparation of this note.

WASHINGTON, D. C., July 3, 1888.

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